Parallel Optimization of Large-Scale Multi-Agent Systems

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The advances in wireless technology necessitate the development of theory, models and tools to cope with new challenges posed by large-scale optimization problems over wireless networks. The classical optimization works under the premise that all problem data is available to some central entity. This centralized design does not apply to large networked (wireless) systems where typically each user (agent) in the network has access to its local information and can exchange only limited signaling with its neighbors. The lecture will cover recent developments of distributed computational models for optimal resource management in multiuser wireless networks, both deterministic and stochastic. Specific topics will include: i) Examine various distributed successive-convex-approximation-based techniques for nonconvex sum-utility optimization problems, subject to private and/or shared constraints; ii) Establish a unified analysis of convergence of (inexact) parallel best-response-based decomposition algorithms; iii) Apply the developed machinery to the design of heterogeneous multi antenna wireless networks; iv) Use stochastic optimization techniques to develop efficient methods for resource management in MIMO wireless interfering networks with limited channel state information.

The content of this lecture is based on a series of recent papers coauthored with (in alphabetic order): Alberth Alvarado, Francisco Facchinei, Daniel Palomar, Jong-Shi Pang, and Peiran Song.